

Spin polarized photoemission study of magnetite films: evidence for half metallic ferromagnetic behavior

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Many materials have been predicted to be half metallic magnets, but only one example was provided experimentally so far. [1] Using the spin-resolving photoelectron spectrometer at the Spectromicroscopy Facility (Beamline 7) at the Advanced Light Source [2], we have found evidence for half-metallic behavior in thin films of magnetite. Thin films of magnetite hold out the possibility of use in devices as pure spin sources. Because our spin resolving experiments are performed at higher photon energies, we were able to monitor the spin polarization of the near Fermi energy electrons without resorting to destructive surface cleaning techniques, using the samples "as is." Furthermore, we have demonstrated that harsh sample cleaning procedures such as ion etching causes the loss of the desired spin polarization, which may help explain the failure of other previous experiments to observe half metallic behavior. The ability to perform the experiments at higher energies is a direct result of the high brightness of the ALS and is probably a unique capability of 3rd Generation Synchrotron Radiation Sources. The experiments at the ALS were supported by growth and characterization studies at UCSD. Magnetite films were prepared by reactive sputtering. Epitaxial magnetite films were grown on MgO and sapphire substrates with precise control of gas flows and substrate temperature. Their structure was characterized by RHEED, LEED, and XRD. Further experiments are in progress.

1. Park et al, Nature **392**, 794 (1998); Phys. Rev. Lett. **81**, 1953 (1998).
2. J.G. Tobin et al, MRS Symp. Proc. **524**, 185 (1998).

This work was supported by the Director, Office of Science, Office of Basic Energy Sciences, U.S. Department of Energy and performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract no. W-7405-Eng-48. Experiments were carried out at the Spectromicroscopy Facility (Beamline 7.0) at the Advanced Light Source, built and supported by the U.S. Department of Energy.

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